

The late Sandbian/Early Katian carbonate succession in the eastern St. Petersburg region: the stratigraphic record in the Krapivno 21 drill core

Linda Hints^{1*}, Oliver Lehnert^{2,3}, Jaak Nõlvak¹, Peep Männik¹, Helje Pärnaste¹ and Michael Joachimski²

¹Tallinn University of Technology, Institute of Geology, Ehitajate tee 5, 19086 Tallinn, Estonia

²GeoZentrum Nordbayern, Friedrich-Alexander Universität Erlangen-Nürnberg (FAU), Schloßgarten 5, D-91054 Erlangen, Germany

³State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology & Palaeontology, Chinese Academy of Sciences, Nanjing 210008, China

* Corresponding author, linda.hints@taltech.ee



This report treats the Krapivno 21 core section drilled ca. 160 km E to SE of St. Petersburg, in shallow water settings of the easternmost Baltoscandian Basin, and deals with strata of late Kukruse, Haljala, and late Keila ages (East Baltic Regional Stages; RS) up to the erosional contact between the Katian and Middle Devonian, thus spanning the Sandbian–Katian transition. We present a compilation of data on shelly faunas (brachiopods, trilobites), microfossils (conodonts, chitinozoans, prasinophytes), and the $\delta^{13}\text{C}$ record in this part of the basin.

The section is composed of sandy dolomitic mudstones and dolostones, with dispersed kukersite-rich layers. The graptolite *Nemagraptus* sp. and the chitinozoan *Eisenackitina rhenana* indicate a late Kukruse age for the strata below a discontinuity surface at 195.5 m. The overlying supratidal sabkha dolostones of the Elizavetino Formation (Fm) are equivalents of the Keila RS in NW Russia. From the base of the latter Fm towards the early Katian (late Keila)/Middle Devonian boundary, five intervals are tentatively distinguished. The post-Kukruse strata in the interval 182–194 m are characterised by transitional species, including the FADs of the chitinozoan *Desmochitina holosphaerica*, the trilobites *Chasmops marginatus* and *Estoniops bekkeri*, and increased abundance of the brachiopod genera *Platystrophia* and *Clinambon*.

The Haljala/Keila boundary presumably falls in the complex of discontinuity surfaces between 179.0 and 181.8 m. The overlying ~16-m-thick biodetrital dolostone unit is rich in shelly fossils characteristic of the latest Sandbian. This fauna of Keila age is characterised by the trilobites *Neoasaphus* sp., *Bolbochasmops bucculentus* and *Estoniops maennili*, the brachiopod genus *Clinambon*, and new species of the brachiopod genera *Hedstroemina* and *Geniculina*. The overlying 15 m yields abundant organic-walled microphytoplankton (*Leiosphaeridia*, *Tasmanites*) and chitinozoans, but macrofossils are scarce. A 6 m thick interval of cavernous biodetrital dolostones above these strata presumably still correlates with the Keila RS. These rocks possibly show organic structures reminding of reefal carbonates. The variegated dolostones between 138 and 145 m contain chitinozoans which cannot be attributed to either the Keila or Oandu RS. With respect to their stratigraphic position, these strata can be compared to the so-called *Leperditia* beds in the Osmino 111 core drilled south of St. Petersburg. Descriptions and ecological interpretations of the *Leperditia* beds in this area do not differ from their analogues in Laurentia. In the East Baltic region, the siliciclastic *Tetrada* beds, named after an ostracod, follow stratigraphically directly above the GICE interval. Whether the *Leperditia* and *Tetrada* beds in the upper Keila RS are contemporaneous remains a matter of future studies.

The $\delta^{13}\text{C}$ record is similar to those described from the East Baltic. The low $\delta^{13}\text{C}$ values (-1–0‰) characterise the interval spanning the Haljala RS and the lower half of the Keila RS with its basal Keila fauna and kerogen-rich beds. The preserved part of the Guttenberg Isotopic Carbon Excursion (GICE) spans a ~15-m thick interval (144.0–159.5 m), the falling limb is cut off, and a late Keila age is assumed for the top of the Ordovician in the core. A comparison with Estonian records suggests that most of the time corresponding to the upper Elizavetino Fm is missing in N Estonia. The *Leperditia* beds fall into the peak interval of GICE, suggesting a possible correlation of this level to reef complexes in N Estonia and the lower Variku Fm (incl. *Tetrada* beds) further south.

Keywords: Ordovician, Baltica, St. Petersburg region, biostratigraphy, stable isotope chemostratigraphy, GICE.